MONTHLY WEATHER REVIEW.

VOL. XX. WASHINGTON, D. C., NOVEMBER, 1892. No. 11.

BOARD OF EDITORS { Mr. Horace E. Smith, Chief Clerk of Weather Bureau, Professors Henry A. Hazen, Thomas Russell, and Charles F. Marvin, and Mr. Edward B. Garriott, in charge of Review Room.

INTRODUCTION.

This REVIEW is based on reports for November, 1892, from 2,899 regular and voluntary observers. These reports are classified as follows: 165 reports from Weather Bureau stations; 48 reports from United States Army post surgeons; 1,961 monthly reports from state weather service and voluntary observers; 219 reports through the Central Pacific Railway Company; 477 marine reports through the co-operation of the Hydrographic Office, Navy Department; 29 reports from Canadian stations; marine reports through the "New York Herald Weather Service"; monthly reports from local services established in all states and territories; and international simultaneous observations. Trustworthy newspaper extracts and special reports have also been used.

CHARACTERISTICS OF THE WEATHER FOR NOVEMBER, 1892.

The month was characterized by an unusually large number of general storms. On the north Pacific coast heavy rain from the 17th to 23d caused great damage by flood, and from the 24th to 30th unusually severe gales and exceptionally heavy rain prevailed over a great part of California. The first heavy frost of the season occurred at Jacksonville, Fla., on the 12th, and at Olympia, Wash., on the 20th. Low temperature from the 9th to the 13th damaged cotton in parts of Arkansas and Louisiana. The Mississippi River was frozen from Keokuk, Iowa, northward, and the Missouri River was closed by ice in North and South Dakota. Drought prevailed in Ohio and Arizona. Meteoric displays were reported throughout the country the night of the 23d.

TEMPERATURE.

The month was warmer than usual in the Rocky Mountain and plateau regions, along the Pacific coast, and over the Canadian Maritime Provinces, the greatest excess in temperature, 4°, being noted over the northern plateau region and in New Brunswick. Over the eastern half of the United States and in the Northwest the temperature was below the normal, the most marked deficiency being noted in the western Saskatchewan and upper Mississippi valleys, where the mean readings were 4° to 6° below the November average. At points in North Carolina, South Carolina, and northern Georgia the cold wave of the 24–25th was attended by the lowest temperature recorded for November.

PRECIPITATION.

The monthly precipitation was unusually heavy on the Pacific coast, where the total rainfall was about double the November average. There was also a marked excess in the middle Mississippi valley, on the south New England coast, and in Nova Scotia. The most marked deficiency was noted over Florida, along the immediate south Atlantic coast, and in central Texas, where the monthly precipitation was 2.00 inches less than the average. The heaviest snowfall was reported along the line of the Central Pacific Railway crossing the summit of the Sierra Nevada Mountains, where a depth of 70 inches was noted.

STORMS.

On the 1st heavy snow impeded travel in Colorado. The early morning of the 6th a destructive tornado visited Galveston Island, Tex.; one life was lost, and property was destroyed to the estimated value of $10,000. On the same date a heavy snowstorm occurred in eastern Montana and the Dakotas, and a gale prevailed over the Great Lakes. On the 7th heavy gales prevailed over the lower lakes.

The night of the 16th a destructive tornado occurred in Boone county, Ark.; 3 persons were reported killed; 50 injured; and the damage to property was estimated at $100,000. Severe local storms occurred in Missouri on that date.

The early morning of the 17th a tornado visited Red Bud, Ill.; 2 persons were reported killed and 7 injured; 82 buildings were destroyed; and the loss of property was placed at about $100,000. On that date destructive local storms occurred in Ohio, Missouri, Louisiana, and Mississippi; heavy wind, with rain or snow, prevailed in Arkansas, Tennessee, Kentucky, Missouri, Iowa, Ohio, and Washington, and heavy gales prevailed over the Great Lakes.

On the 18th high winds prevailed over New England, New York, and the middle Atlantic states. On the 24th and 25th a heavy snowstorm, with high wind and low temperature, prevailed in the Northwest. On the 29th a strong gale, with rain changing to snow, occurred along the New England coast and over Long Island.

ATMOSPHERIC PRESSURE (expressed in inches and hundredths).

The distribution of mean atmospheric pressure for November, 1892, as determined from observations taken daily at 8 a. m. and 8 p. m. (75th meridian time), is shown on Chart II by isobars.

In November the normal pressure is highest over the middle plateau region, where it is above 30.20; it is above 30.15 over the interior of the middle and east Gulf and south Atlantic states. The normal pressure for November is lowest over the Gulf of Saint Lawrence, where it is below 30.00. There is usually an increase of pressure over the United

States and Canada in November, the increase being most marked over the middle plateau region, where it exceeds .10. From the lower lakes over the Canadian Maritime Provinces the normal pressure is .05, or more, lower than for October.

In November, 1892, the mean pressure was highest east of the Mississippi and south of the Ohio rivers, and in an area extending from the middle plateau region to the southeast slope of the Rocky Mountains, where it was above 30.15. The mean pressure was lowest on the extreme north Pacific coast, where it was below 29.90, and the mean readings were below 30.00 from the Washington coast over northern Montana, over the British Northwest Territory, and over the Gulf of Saint Lawrence.

A comparison of the pressure chart for November, 1892, with that of the preceding month shows a general increase of pressure, except over the northern Rocky Mountain and plateau regions and on the north Pacific coast. The greatest increase of pressure was shown over the Canadian Maritime Provinces, where it was .20 to .30. The most marked decrease of pressure was noted on the extreme north Pacific coast, where the mean values were .10 to .13 lower than for October.

The mean pressure was below the normal over the Pacific coast states, the Rocky Mountain and western and northern plateau regions, the middle and upper Missouri and Red River valleys, and from the eastern lake region to the middle Atlantic and south New England coasts. From the extreme upper Mississippi valley and the upper lake region to the east Gulf and south Atlantic coasts, and from the southeastern plateau region over southern Texas and the middle and west Gulf coasts the mean pressure was above the normal. The most marked departure below the normal pressure was noted from the Washington coast over the northeast slope of the Rocky Mountains, where it was more than .10, and the greatest departure above the normal was shown over the Florida Peninsula, where it exceeded .05.

HIGH AND LOW AREAS.

The tracks of areas of high and low barometric pressure for November, 1892, are plotted on Charts IV and I, respectively, and some of the more prominent features of the areas are shown in the table at the end of this chapter.

HIGH AREAS.

Ten high areas appeared, the average number traced for November during the last 17 years being 7.2. One of the high areas occupied the Lake Superior region at the opening of the month, 6 advanced from the north Pacific coast, and 3 appeared over the Saskatchewan Valley. Four of the Pacific coast high areas traversed the continent, and 2 disappeared by a decrease of pressure over the middle Rocky Mountain region. Two of the high areas from the Saskatchewan Valley reached the south Atlantic coast, and 1 occupied the Lake region at the close of the month. The general course of the Pacific high areas was southeastward over the middle and southern Rocky Mountain regions and thence to the south Atlantic coast. One of the high areas moved from the north Pacific coast to Manitoba and thence to the south Atlantic coast, and another passed from the north Pacific coast to the southeast slope of the Rocky Mountains, thence to the Lake region, and thence to the Gulf of Saint Lawrence. The average velocity of high areas, 30 statute miles per hour, was somewhat greater than the average velocity of November high areas. The following is a description of the high areas traced for the current month:

I.—Occupied the region north of Lake Superior at the opening of the month, and moved thence eastward to the Gulf of Saint Lawrence by the 2d, with pressure above 30.50 over Quebec. On the 1st the temperature fell about 10° over eastern Ontario, and on the 2d the minimum temperature was below the freezing point throughout northern New England.

II.—Occupied the north Pacific coast at the opening of the month, with pressure 30.40. On that date the temperature fell 10° to 20° in the middle Rocky Mountain region, and the minimum temperature at Havre, Mont., was 18°. During the 2d this high area moved southeastward over the middle plateau region where it remained nearly stationary during the 3d and 4th, after which it united with high area III which had advanced from Manitoba. Attending the advance of this high area a marked fall in temperature was noted over the interior of Texas on the 2d, from eastern Texas over the Ohio Valley on the 3d, and over the interior of the east Gulf states and on the middle Atlantic coast on the 4th.

III.—Appeared over Manitoba the evening of the 3d, and during the 4th passed to the upper Mississippi valley, with pressure 30.40 at the morning report, and a fall in temperature of 10° to 20° from the Dakotas over the Great Lakes. During the 5th the center advanced to West Virginia, a marked fall in temperature occurred over the Atlantic coast states, and the mimimum temperature fell to 24° at Columbus, Ohio. By the morning of the 6th the high area had reached the middle Atlantic coast, and the line of freezing weather was carried to North Carolina.

IV.—Appeared on the north Pacific coast the evening of the 5th, with pressure above 30.30. On that date the temperature fell 10° to 20° from the north Pacific coast over the northeast slope of the Rocky Mountains. During the 6th the center advanced to the northern Rocky Mountain region, and the temperature fell 30° to 40°, and was 20° below the normal over the Dakotas. By the evening report of the 7th the high area had passed to the southeast slope of the Rocky Mountains, the temperature had fallen 20° to 30° over the north-central states, the morning minimum temperature was zero at Bismarck, N. Dak., and the line of freezing weather extended to Oklahoma. During the 8th the center moved northeastward over the upper Mississippi valley, the cold wave reached the Atlantic coast at night, the temperature fell more than 20° in western Pennsylvania and western New York, the morning minimum temperature at Huron, S. Dak., was —4°, and the line of freezing weather was carried to Arkansas and Kentucky. During the 9th the high area moved eastward north of the lower lakes and Saint Lawrence River, the temperature fell more than 20° over parts of the middle Atlantic states, and the line of freezing weather crossed Arkansas.

V.—The cold wave which overspread the eastern part of the country on the 8th and 9th apparently settled southward over the south Atlantic and east Gulf states. This high area advanced rapidly southeastward from the north Pacific coast and reached Texas the morning of the 10th, with pressure above 30.60. On that date the temperature fell more than 20° over the south Atlantic states, and freezing weather was reported in central Texas, Tennessee, and Virginia. During the 11th the high area moved slowly eastward over the west part of the Gulf of Mexico, and the line of freezing weather extended over the interior of the east Gulf and south Atlantic states. By the evening of the 12th a ridge of high pressure had formed, covering districts between Lake Huron and the east Gulf coast, and the morning of the 12th the first heavy frost of the season was noted at Jacksonville, Fla.

VI.—This high area apparently approached the north Pacific coast from the southwest, and the evening of the 12th was central near the mouth of the Columbia River, with pressure above 30.50. On that date a slight fall in temperature occurred over the northern plateau and northern Rocky Mountain regions. During the 13th the center moved southeastward over the middle plateau region, with pressure above 30.50 at the morning report, and the temperature fell 10° to 20° between the Mississippi River and the Rocky Mountains. By the evening of the 14th the center had reached the west Gulf coast, the temperature had fallen 10° to 18° from the western

lake region to the Gulf of Mexico, and the line of freezing weather crossed Oklahoma and Tennessee. During the 15th and 16th the high area moved slowly eastward over the east Gulf states, and apparently passed thence northeastward off the south Atlantic coast.

VII.—The pressure was high off the Oregon and north California coasts on the 14th and 15th, and on the 16th this high area moved slowly eastward over Oregon, with pressure above 30.30. On the 17th the center advanced over the middle plateau region, with pressure above 30.50, and a cool wave which had covered the plateau and Rocky Mountain regions on the 16th caused a temperature fall of about 20° in the Southwest. During the 18th the high area overspread the Southwest, attended by a fall in temperature of 10° to 20° in the middle and south Atlantic states, and by the morning of the 19th formed the southern part of a ridge of high pressure which extended from Manitoba to Texas.

VIII.—Occupied the eastern Saskatchewan valley the evening of the 18th, with pressure above 30.30. On that date the temperature fell 10° to 16° in the Saskatchewan Valley. During the 19th the high area advanced to Tennessee, the temperature fell more than 10° from the lower Missouri valley over the western lake region, and the morning minimum temperature at Saint Vincent, Minn., was 6°. During the 20th the high area passed off the south Atlantic coast, with pressure above 30.30 at the morning report, the temperature fell slightly along the south Atlantic coast north of Florida, and the line of freezing weather crossed the interior of the east Gulf and south Atlantic states.

IX.—Appeared on the north Pacific coast the night of the 19th, and the morning of the 20th occupied southern Alberta. On the 20th a marked fall in temperature occurred in the Northwest, the minimum temperature fell to —10° at Swift Current, N. W. T., and the first heavy frost of the season was noted at Olympia, Wash. From the 21st to the 23d this high area moved slowly eastward over Manitoba, with pressure above 30.90 on the 22d. On the 21st the temperature fell 10° to 20° in the Mississippi and Ohio valleys, and the minimum temperature at Saint Vincent, Minn., was —16°. On the 22d the temperature fell more than 10° in the Lake region and on the Atlantic coast, and the morning minimum at Saint Vincent, Minn., was —22°.

On the 23d the 24-hour temperature fall exceeded 10° from the middle Mississippi valley to the middle Atlantic coast, and the line of freezing weather extended to northern Georgia. During the 24th this high area moved rapidly southeastward to eastern Kentucky, with a marked decrease of pressure, the temperature fell more than 10° in the south Atlantic states, and the line of freezing weather extended to the southern part of the east Gulf states and to southern Georgia. On the 25th the center reached the south Atlantic coast, and the morning minimum temperature was below the freezing point generally over the east Gulf and south Atlantic states.

X.—From the 23d to the 26th an area of high barometric pressure occupied the Saskatchewan Valley. During that period a cold wave extended from the north Pacific coast states and the northern Rocky Mountain region to the Missouri Valley, with temperature falling to zero on the northeast slope of the Rocky Mountains on the 24th and 25th. On the 24th the temperature fell from 56° to zero at Lander, Wyo., with snow in the evening. The morning of the 26th this high area was central north of Montana, with pressure above 30.20 and temperature below zero over the Dakotas. By the night of the 27th an extensive high area covered districts lying between the western lake region and the southern plateau, the temperature had fallen about 10° in the Southwest, and a minimum temperature of —20° was registered in the morning at Minnedosa, Man.

During the 28th the high area moved eastward over the upper and middle Mississippi valleys, with pressure above 30.30, the temperature fell 10° to 20° from eastern Texas over western Kentucky and Tennessee, and the line of freezing weather reached Virginia. On the 29th the center occupied the upper Ohio valley, and the line of freezing weather extended to North Carolina. During the 30th this high area moved northward over the central lake region, and the line of freezing weather reached the interior of the east Gulf and south Atlantic states.

LOW AREAS.

The principal track of November areas of low barometric pressure crosses the continent between the 45th and 50th parallels; less frequented tracks are traced from the Saskatchewan Valley, the middle plateau region, and Texas to the Lake region or Saint Lawrence Valley, and well-defined low areas, averaging about two per month, advance northward off the middle Atlantic coast. The region of greatest storm frequency embraces Canada east of the 80th meridian, where the average number of low areas exceeds five per month. An average of about two low areas per month appears on the north Pacific coast, and the number traced from that region across the continent averages less than one per month. The average velocity of low areas increases from 25 statute miles per hour in the summer months to 31 miles per hour in November.

The tracks of 16 low areas are plotted on Chart I for November, 1892, the average number traced for the corresponding month of the last 17 years being 12. Of the low areas traced for the current month one was a continuation of low area X for October, 1892, five advanced from the north Pacific coast, four first appeared in the Saskatchewan Valley, one developed on the middle-eastern slope, and two on the southeastern slope of the Rocky Mountains, one advanced northeastward from the Gulf of Mexico, one originated over the Carolinas, and one, apparently a secondary development to low area XV, moved northeastward off the middle Atlantic and New England coasts the last three days of the month.

All of the low areas from the Pacific coast dissipated over the interior of the country, one, number XIII, reaching the eastern lake region. Three of the low areas from the Saskatchewan Valley passed eastward over the Canadian Maritime Provinces. But one of the low areas that appeared over the Rocky Mountain regions reached the Atlantic coast. The general course of the low areas was toward the Canadian Maritime Provinces, and the greatest intensity was attained when they diverged, or were forced, from a normal course. A storm of marked severity prevailed on the north Pacific coast the last six days of the month. The following is a description of the low areas referred to:

I.—Was a continuation of low area X for October and at the opening of the month was central over Arkansas, with pressure below 29.80. During the 1st the center of disturbance advanced over the Ohio Valley, with a slight increase in energy, rain fell generally in the Lake region and central valleys, and the temperature rose slightly in the middle and south Atlantic states. On the 2d the low area reached the middle Saint Lawrence valley, rain fell generally east of the Mississippi River, and a slight rise in temperature occurred in the Atlantic coast states. During the 3d the center moved eastward over Nova Scotia, with pressure 29.60 at the evening report, and the weather continued unsettled over the Eastern States.

II.—Appeared over the western Saskatchewan valley the evening of the 2d, with pressure below 29.70, and rain over the northern plateau region. During the 3d the center advanced to Minnesota, the temperature rose slightly from the Missouri Valley to the Lake region, and the rain area extended over Lake Superior. By the night of the 4th the cen-

ter had reached northern New England, and a secondary disturbance had advanced northeastward along the middle Atlantic and New England coasts. On that date rain fell from the Ohio and upper Mississippi valleys to the Gulf of Mexico, and rain changed to snow, and north to west gales prevailed over the Great Lakes. By the morning of the 5th the storm center had passed southward off the New England coast with a marked increase of strength; it moved thence eastward south of Nova Scotia by the evening report. Snow was quickly followed by clearing weather over the northeastern states, and northwest gales prevailed along the middle Atlantic and New England coasts.

III.—The pressure decreased in the Saskatchewan Valley during the 4th, and the morning of the 5th this low area was central over southern Alberta, with pressure below 29.60. By the evening report the center had advanced to the Dakotas. On that date rain or snow fell on the northeast slope of the Rocky Mountains, and the temperature rose 10° to 20° in the middle Missouri valley. During the 6th the center of disturbance passed to western Lake Superior, with pressure below 29.40 at the morning report, rain fell from the western lake region over the Mississippi Valley, high northwest winds and snow prevailed over the middle Missouri valley, and southerly gales were encountered over Lake Michigan. On the 7th the center moved slowly eastward over the northern lake region, rain fell generally east of the Mississippi River and the Red River of the North, changing to snow in the western lake region, and southwest gales prevailed over the southern lake region. During the 8th this low area passed eastward north of the Gulf of Saint Lawrence, rain was followed by clearing weather in the Atlantic coast states, and high westerly winds with snow flurries continued over the Great Lakes.

IV.—Advanced from the Gulf of Mexico and the morning of the 9th was central on the middle Gulf coast, with pressure below 30.00. By the evening report the center had moved over the interior of the south Atlantic states, and rain had fallen generally in the east Gulf and south Atlantic states, and snow in the Ohio Valley and Tennessee, and the mountains of Maryland and Virginia. During the 10th the center moved northeastward, and at the evening report was central near Eastport, Me., with pressure below 29.50, the rain area contracted to the immediate Atlantic coast, and high north to west winds prevailed along the Atlantic coast north of Hatteras, N. C. By the morning of the 11th the storm-center had passed over Newfoundland.

V.—Appeared over Alberta on the 9th and during the 10th advanced to Manitoba, with pressure below 29.60 in the lower valley of the Red River of the North. On the 10th rain fell in the Dakotas and Montana, and the temperature rose 20° in South Dakota. On the 11th the center passed to Georgian Bay, rain or snow fell generally in the Lake region, and south to west gales prevailed over Lake Michigan. During the 12th this low area apparently dissipated over the Saint Lawrence Valley.

VI.—Advanced from the north Pacific coast and the evening of the 11th was central north of Montana, with pressure below 29.60. On that date rain fell on the north Pacific coast and in areas in the upper Missouri valley, high southwest winds prevailed on the north Pacific coast, and the temperature rose slightly on the northeast slope of the Rocky Mountains. During the 12th the storm center advanced to Manitoba, with pressure below 29.40 at the evening report, rain fell on the northeast slope of the Rocky Mountains and in the Red River of the North Valley, and high winds were noted in the Missouri Valley. On the 13th the low area occupied the Lake Superior region, and rain fell in the north-central districts. During the 14th this low area apparently dissipated north of the Saint Lawrence Valley.

VII.—Advanced from the north Pacific coast and the morning of the 14th was central over the upper Saskatchewan valley, with pressure 29.10. On that date the center moved slowly eastward with an apparent loss of energy, rain fell from the north Pacific coast over the northeast slope of the Rocky Mountains, snow was reported in the middle Saskatchewan valley, and high south to west winds prevailed in the Rocky Mountain regions, a velocity of 99 miles per hour from the west being noted at Pikes Peak, Colo. During the 15th this low area apparently dissipated north of Minnesota and North Dakota.

VIII.—During the 14th the pressure decreased rapidly and a marked rise in temperature occurred from the upper Ohio valley to the south Atlantic coast, and at the evening report a trough of low pressure extended from West Virginia to the Georgia coast. The night of the 14–15th the low area developed and on the 15th was central on the North Carolina and Virginia coasts, with pressure below 29.70. On that date rain fell from the eastern lake region to the south Atlantic coast, the rainfall being exceptionally heavy in New Jersey, eastern Pennsylvania, southeastern New York, and Connecticut, and high winds prevailed along the middle Atlantic and south New England coasts. During the 16th the center passed northward over New England, the rain area contracted over New England, and south to east gales prevailed along the New England coast in the morning. During the 17th the center disappeared north of the Gulf of Saint Lawrence.

IX.—The morning of the 15th a trough of low pressure extended from Manitoba to Texas, with two areas of lower pressure, one, number VII, over the eastern Saskatchewan valley, and the other, number IX, over Kansas. By the evening report low area IX had advanced to Iowa, the pressure continued low over the Saskatchewan Valley, and a secondary development, low area X, appeared over western Texas. No rain fell in connection with this low area on the 15th. During the 16th the center of disturbance moved over Lake Superior and passing thence eastward united over the Saint Lawrence Valley with low area VIII.

X.—This low area was attended by the severest storms of the month over the interior of the country. The evening of the 15th, when number IX occupied Iowa, this low area appeared over western Texas, with pressure below 29.80. During the 16th the center of disturbance advanced over Oklahoma Territory, with pressure below 29.60, rain fell in a limited area covering the middle Mississippi and lower Missouri valleys, and west to northwest gales occurred in the middle and southern Rocky Mountain regions. The night of the 16th destructive local storms occurred in Missouri and Arkansas. During the 17th the center moved to southeastern Wisconsin, with pressure falling to 29.02 at Milwaukee at the evening report, the temperature rose 10° to 20° from the eastern lake region to Florida, and the temperature was 20° above the normal in the upper Ohio valley, rain fell from the Lake region to the Gulf of Mexico, and a snowstorm prevailed in the upper Mississippi valley.

In the Mississippi, Ohio, and lower Missouri valleys the storms that attended this low area were exceptionally severe on the 17th. At Red Bud, Ill., a well-defined tornado occurred in the early morning. By the morning of the 18th the center had passed over eastern Lake Superior, without an appreciable loss of strength, and by the evening report it had passed north of Georgian Bay. On that date the rain area contracted to the middle and south Atlantic coasts, the Lake region, and New England, and destructive gales prevailed from the middle Atlantic and New England coasts over the Ohio and upper Mississippi valleys and the Lake region. During the 19th the low area passed to the lower Saint Lawrence valley with a marked decrease of strength, and rain or snow fell in the Lake region and middle Atlantic and New England states. During the 20th this low area

passed southeastward over Nova Scotia, and the pressure continued low over the Canadian Maritime Provinces until the 25th.

XI.—Followed closely number VII and the evening of the 15th occupied the upper Saskatchewan valley, with pressure below 29.40 and rain from the middle and north Pacific coasts over the northern plateau region. Moving rapidly southeastward this low area united with number X by the morning of the 17th.

XII.—Advanced from the north Pacific coast and the morning of the 17th was central north of Washington, with pressure below 29.70. By the evening of the 17th the center had advanced over the middle Saskatchewan valley. On that date heavy rain fell on the north Pacific coast and the rain area extended over the northern plateau region. During the 18th this low area apparently moved rapidly eastward and united with number X.

XIII.—Appeared on the north Pacific coast on the 18th, with pressure below 30.00. On that date rain fell from the north Pacific coast to western Montana, the rainfall being very heavy in western Washington, and wind velocities of 50 to 60 miles per hour were noted on the Washington coast. During the 19th the center advanced to the northeast slope of the Rocky Mountains, with pressure below 29.40, the temperature rose 10° to 20° over the northern Rocky Mountain region, the rain area extended to the Saskatchewan and upper Missouri valleys, and heavy rain and high winds continued on the north Pacific coast. During the 20th this low area moved to Wisconsin, with a marked decrease of strength, snow fell from the Dakotas over the northern lake region, and west to northwest gales were noted in the Missouri Valley. On the 21st the center moved rapidly eastward and apparently united with an area of low pressure which occupied the Canadian Maritime Provinces.

XIV.—Appeared on the north Pacific coast on the 22d, with pressure below 29.60. Heavy rain continued on the north Pacific coast, and the rain area extended over the northeast slope of the Rocky Mountains; on the Washington coast wind velocities of more than 60 miles per hour were recorded. During the 23d the center of disturbance advanced to Idaho, the rain area extended from the middle and north Pacific coasts to the Saskatchewan Valley, and south to west gales occurred in Nevada and Utah. On the 24th the low area moved to Colorado, with pressure below 29.40 at the morning report, the rain area extended to the Missouri and lower Mississippi valleys, snow fell in the Northwest, and high winds, with sleet and snow, prevailed from the middle plateau over Montana and the Dakotas. During the 25th the center of disturbance advanced to northeastern Nebraska and thence to the valley of the Red River of the North, rain or snow fell in central and north-central districts, high winds and snow continued in the Northwest, and a southeast gale prevailed over Lake Michigan. During the 26th this low area disappeared north of the Lake region.

XV and XV*a*.—Appeared on the southeast slope of the Rocky Mountains on the 26th, and passed thence to the upper Ohio valley by the morning of the 28th without evidence of marked energy. On the 26th the temperature rose slightly in the east Gulf states, and rain fell in Arkansas and Tennessee. On the 27th the rain area extended from the upper Mississippi valley and the western lake region to the interior of the Gulf and south Atlantic states, and heavy, moist snow fell in the central lake region. During the 28th low area XV*a* appeared off the North Carolina coast, snow fell in the eastern lake region, the rain area contracted to the middle and south Atlantic coasts, and high northeast winds, with rain, sleet, and snow, set in over southern New England. On the 29th the storm-center moved slowly northeastward off the middle Atlantic coast, with pressure below 29.80 at the evening report, snow or rain fell from the lower lakes to the middle Atlantic and New England coasts, and northeast gales, reaching 70 miles per hour at Block Island, prevailed on the south New England coast. At the close of the month this low area was central off the New England coast, and snow and high winds continued on the Massachusetts and Maine coasts.

XVI.—The center of this low area did not appear within

Tabulated statement showing principal characteristics of areas of high and low pressure.

Barometer.	First observed.			Last observed.		Duration.	Velocity per hour.	Maximum pressure change in 12 hours, maximum abnormal temperature change in 12 hours, and maximum wind velocity.									
	Date.	Lat. N.	Long. W.	Lat. N.	Long. W.			Station.	Rise.	Date.	Station.	Fall.	Date.	Station.	Direction.	Miles per hour.	Date.
High areas.		°	°	°	°	*Days.*	*Miles.*		*Inch.*			°					
I	1	50	85	48	65	1.0	39	Sydney, C. B. I	.34	2	Kingston, Ont	11	1	Block Island, R. I	e.	24	1
II	1	45	121	40	107	3.0	14	Medicine Hat, N. W. T	.26	1	Pueblo, Colo	20	1	Tucson, Ariz	se.	34	4
III	3	53	100	36	75	2.5	30	Davenport, Iowa	.44	4	Parry Sound, Ont	22	4	Saint Louis, Mo	nw.	38	4
IV	5	45	124	50	60	4.5	36	Miles City, Mont	.60	6	Pierre, S. Dak	31	6	Northfield, Vt	n.	36	9
V	8	47	123	43	63	6.0	31	Lander, Wyo	.30	9	Wilmington, N. C	27	10	Fort Canby, Wash	nw.	32	7
VI	12	46	125	35	72	4.5	41	Northfield, Vt	.42	17	Springfield, Mo	21	14	Amarillo, Tex	n.	40	13
VII	16	43	125	40	110	1.5	27	Abilene, Tex	.56	17	Vicksburg, Miss	26	17	Fort Canby, Wash	nw.	42	16
VIII	18	52	106	34	81	1.5	50	Qu'Appelle, N. W. T	.46	18	Qu'Appelle, N. W. T	21	18	Kittyhawk, N. C	nw.	36	20
IX	20	51	114	34	80	5.2	17	Havre, Mont	.84	20	North Platte, Nebr	32	20	Sandusky, Ohio	w.	36	23
X	26	53	112	42	83	4.5	24	Louisville, Ky	.26	28	Winnipeg, Man	26	26	Cheyenne, Wyo	sw.	34	26
Mean						3.4	31		.45			24				35	
Low areas.									Fall.			Rise.					
I	1	35	93	46	59	2.5	34	Halifax, N. S	.56	3	Knoxville, Tenn	16	1	Shreveport, La	s.	38	1
														Buffalo, N. Y	sw.	38	2
II	2	53	113	44	60	3.0	40	Calgary, N. W. T	.32	2	Fort Buford, N. Dak	16	2	Woods Holl, Mass	nw.	52	5
III	5	51	112	50	70	3.0	31	Pierre, S. Dak	.48	5	Louisville, Ky	21	6	Rapid City, S. Dak	nw.	60	6
IV	9	30	88	45	66	1.5	44	Chatham, N. B	.80	10	Wilmington, N. C	17	10	Block Island, R. I	ne.	48	10
V	9	53	117	47	82	2.0	35	Saint Vincent, Minn	.56	10	Swift Current, N. W. T	22	10	Chicago, Ill	nw.	40	11
VI	11	53	114	48	80	2.5	27	Winnipeg, Man	.42	12	La Crosse, Wis	19	13	Helena, Mont	sw.	56	12
VII	14	54	113	53	102	1.0	19	Swift Current, N. W. T	.78	14	Havre, Mont	21	14	Amarillo, Tex †	s.	56	14
VIII	15	36	76	49	68	2.0	23	Chatham, N. B	.50	16	Lynchburg, Va	17	14	Block Island, R. I	se.	60	16
IX	15	39	98	47	87	1.0	33	Nashville, Tenn	.24	15	Keokuk, Iowa	14	15	Amarillo, Tex	n.	42	15
X	15	32	100	45	60	5.0	23	Green Bay, Wis	.62	17	Louisville, Ky	17	16	Lexington, Ky	se.	60	17
XI	15	54	110	40	91	1.5	42	Medicine Hat, N. W. T	.26	15	Minnedosa, Man	17	16	Cheyenne, Wyo	nw.	50	16
XII	17	52	120	52	110	0.5	37	Swift Current, N. W. T	.42	17	Havre, Mont	11	17	Tatoosh Island, Wash	s.	50	17
XIII	18	48	123	46	82	2.5	34	Fort Buford, N. Dak	.62	19	Saint Louis, Mo	21	20	do	e.	60	18
XIV	22	49	125	49	95	3.5	27	Calgary, N. W. T	.48	22	Fort Smith, Ark	17	25	Fort Canby, Wash	s.	66	22
XV	26	34	100	42	79	1.5	36	Parkersburg, W. Va	.32	27	Augusta, Ga	14	26	El Paso, Tex	w.	32	26
XV*a*	28	35	74	42	66	2.0	13	Halifax, N. S	.24	30	Atlantic City, N. J	10	28	Block Island, R. I	ne.	70	29
XVI*								Portland, Oregon	.46	27	Montrose, Colo	29	28	Fort Canby, Wash	se.	72	28
Mean						2.2	31		.47			17				54	

*Central off north Pacific coast from 24th to close of month.

† Pikes Peak, Colo., w., 99, 14th.

the region of observation in November. The evening of the 24th, when low area XIV was central over Colorado, a marked decrease of pressure was shown on the north Pacific coast, the barometer reading below 29.60, with heavy rain and southeast gales on the Washington coast. On the 25th the barometer continued low, with heavy rain in the Pacific coast states north of the 37th parallel. From the 26th to the close of the month exceptionally heavy rains and high winds prevailed in California. On the 27th the pressure fell below 29.00 on the Washington coast, with wind velocities of 50 miles per hour at Fort Canby and Tatoosh Island.

The pressure continued below 29.00 on the Washington coast until the morning of the 28th, the wind reached a velocity of 72 miles per hour from the southeast at Fort Canby, Wash., and 52 miles per hour from the southeast were registered at San Francisco, Cal. On the 29th the pressure was below 29.40 over western Washington, and heavy rains and high winds continued in the Pacific coast states. During the 30th the pressure decreased on the north Pacific coast, a reading of 29.06 being reported at Tatoosh Island at the evening report, wind velocities of 60 to 70 miles per hour occurred on the Washington coast, very heavy rain continued in the Pacific coast states, and a velocity of 56 miles per hour from the northeast was noted at San Francisco, Cal.

NORTH ATLANTIC STORMS FOR NOVEMBER, 1892.

[*Pressure in inches and millimeters; wind-force by Beaufort scale.*]

The paths of storms that appeared over the west part of the north Atlantic Ocean during November, 1892, are shown on Chart I. These paths have been determined from reports of observations by shipmasters received through the co-operation of the Hydrographic Office, Navy Department, and the "New York Herald Weather Service."

In November there is usually a decrease of atmospheric pressure over the north Atlantic Ocean, the decrease being most marked north of the British Isles, where the Iceland winter area of low pressure is forming. A large proportion of the storms of November move from Newfoundland toward the region north of the British Isles; their average velocity is about 21 statute miles per hour; and an average of two storms per month traverse the ocean from the American to the European coasts.

The severest disturbances of November, 1892, attended the passage of a storm which moved from the region between Bermuda and the North Carolina coast northeastward over Newfoundland during the last three days of October. Reports of November 1st show this storm central northeast of the Banks of Newfoundland, with pressure about 28.70 (729) and north to west gales of force 9 to 10. By the morning of the 2d the storm-center had advanced eastward to the 35th meridian, and northwest gales of hurricane force were encountered between the 35th and 40th meridians. During the next 24 hours the center of disturbance moved eastward about 10 degrees without any appreciable loss of strength; the central pressure continued about 28.70 (729); and northwest gales of force 10 to 11 were reported to the westward of the storm-center. Reports of the 4th locate the storm somewhat to the westward of Ireland. By the 5th it had passed north of the British Isles.

The morning of the 4th low area I was central south of Newfoundland, and low area II*a* occupied the middle Atlantic coast. By the morning of the 5th low area I had passed eastward over the Banks of Newfoundland, low area II had moved southward over Maine, and low area II*a* had advanced to a position southeast of Nova Scotia. On that date the pressure fell to about 29.30 (744) on the west edge of the Grand Banks, and northwest gales of force 10 to 11 were encountered between the 60th and 70th meridians. By the morning of the 6th low areas II and II*a* had united south of Newfoundland; over the Banks of Newfoundland the pressure fell to about 29.20 (742), and strong to whole gales occurred during the day between the 40th and 50th meridians. By the 7th this storm had passed rapidly northeastward beyond the region of observation.

From the 10th to the 14th a storm of marked energy, low area IV, advanced from New Brunswick to the British Isles. This storm originated in the Gulf of Mexico, moved northeastward over the east Gulf and south Atlantic states during the 9th, and reached New Brunswick the night of the 10th. Reports of the 11th locate the storm-center north of Newfoundland, with pressure about 29.40 (747), from which region it passed eastward to mid-ocean by the 12th, and thence to a position west of the British Isles by the 13th, with pressure about 29.00 (736) on the last-named date. During the 14th the center apparently moved east or northeast over the British Isles.

Unsettled weather prevailed along the middle Atlantic and New England coasts from the 15th to 17th, attending the passage from the North Carolina coast to the lower Saint Lawrence valley of low area VIII. On the 19th a storm of marked strength, with pressure about 29.30 (744) appeared near the trans-Atlantic steamship tracks between the 20th and 30th meridians. By the 20th this storm had increased in intensity, and reports showed pressure about 28.90 (734) near the 20th meridian. On the 21st the center of disturbance had shifted position to the westward, and pressure about 29.20 (742) was noted near the 30th meridian. On that date low area X appeared southeast of Nova Scotia.

By the 22d low area X and the storm-central over mid-ocean on the 21st had apparently united near the 40th meridian. On that date the lowest pressure reported was about 29.20 (742), and heavy gales prevailed over mid-ocean. This storm occupied the region north of the Grand Banks until the 25th. From the 28th to the 30th unsettled weather prevailed off the middle Atlantic and New England coasts attending the passage of low area XV*a*, and on the 30th severe gales were reported west of the Banks of Newfoundland. On the 29th a storm of moderate strength moved northeastward over the Banks of Newfoundland.

OCEAN ICE IN NOVEMBER.

No Arctic ice was reported for November, 1892. In November, 1891, an iceberg was observed in N. 51° 58′, W. 55° 35′, on the 8th. In November, 1890, a small piece of ice was noted in N. 46° 35′, W. 47° 51′. In November, 1882, 1883, 1887, and 1888, no ice was reported near Newfoundland and the Grand Banks. In November, 1884 and 1889, several icebergs were seen over the eastern part of the Banks of Newfoundland. On one date in November, 1885, and one date in November, 1886, ice was observed south of the 50th parallel.

OCEAN FOG IN NOVEMBER.

The limits of fog belts west of the 40th meridian, as determined by reports of shipmasters, are shown on Chart I by dotted shading. Near the Banks of Newfoundland fog was reported on 14 dates; between the 55th and 65th meridians on 3 dates; and west of the 65th meridian on 1 date. Compared with the corresponding month of the last 5 years the dates of occurrence of fog near the Grand Banks numbered 4 more than the average; between the 55th and 65th meridians the same as the average; and west of the 65th meridian 3 less